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Models of Hα Doppler profiles from a hydrogen-filled drift tube at high E/N A.V. PHELPS, JILA, University of Colorado and NIST — Doppler profiles are calculated for the Hα line excited in collisions of fast atoms, ions, molecules, and electrons with H_2 in a low-current, uniform-electric-field drift tube at high E/N, where E is the electric field and N is the gas density. Starting with a multi-beam model of the particle fluxes and energy distributions and assumed angular distributions of particles approaching and reflected by the cathode, we calculate the velocity distributions of excited atoms relative to an observer. Spectral profiles are compared with measurements parallel to the tube axis, e.g., for $E/N = 10$ kTd (1 Td = 10^{-21} V m^2) at 0.15 Torr and 4 cm electrode separation.[1] Spectrally integrated intensity measurements are normalized to electron excitation data at low E/N. Excitation is principally by fast H + H_2 $\rightarrow$ fast H(n=3) + H_2. The calculated magnitude, high degree of profile asymmetry, large change in emission by reflected atoms with cathode material, and change in integrated intensity with E/N agree well with experiment. Predictions are made for observations perpendicular to the tube axis and for a simplified cathode fall model.

[1]Z. Lj. Petrović, B. M. Jelenković and A. V. Phelps, Phys. Rev. Lett. **68**, 325 (1992).

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